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GRADE 12 DIPLOMA EXAMINATION

Chemistry 30

June 1992

Alberta
EDUCATION

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**GRADE 12 DIPLOMA EXAMINATION
CHEMISTRY 30**

DESCRIPTION

Time allotted: 2.5 hours

Total possible marks: 70

This is a **closed-book** examination consisting of **three** parts:

PART A has 42 multiple-choice questions each with a value of one mark.

PART B has seven numerical-response questions each with a value of one mark.

PART C has three written-response questions for a total of 21 marks.

A chemistry data booklet is provided for your reference.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

GENERAL INSTRUCTIONS

Fill in the information required on the answer sheet and the examination booklet as directed by the presiding examiner.

You are expected to provide your own scientific calculator.

Carefully read the instructions for each part before proceeding.

DO NOT FOLD EITHER THE ANSWER SHEET OR THE EXAMINATION BOOKLET.

The presiding examiner will collect your answer sheet and examination booklet and send them to Alberta Education.

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PART A

INSTRUCTIONS

In this part of the examination, there are 42 multiple-choice questions each with a value of one mark. All numbers used in the questions are to be considered as the result of a measurement.

Read each question carefully and decide which of the choices **best** completes the statement or answers the question. Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice. **Use an HB pencil only.**

Example

This diploma examination is for the subject of

Answer Sheet

A B C D

- A. biology
- B. physics
- C. chemistry
- D. mathematics

If you wish to change an answer, erase your first mark completely.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

**DO NOT TURN THE PAGE TO START THE EXAMINATION UNTIL
TOLD TO DO SO BY THE PRESIDING EXAMINER.**

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THE STATE OF THE UNION

FOR THE USE OF THE HOUSE OF REPRESENTATIVES

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- The law of conservation of energy states that
 - energy cannot be destroyed, only transformed
 - kinetic energy cannot be transformed into potential energy
 - potential energy cannot be transformed into kinetic energy
 - atomic nuclei cannot be divided
- When a compound is formed from elements, the enthalpy of the compound in relation to the enthalpy of the elements will
 - increase only
 - decrease only
 - remain the same
 - increase or decrease

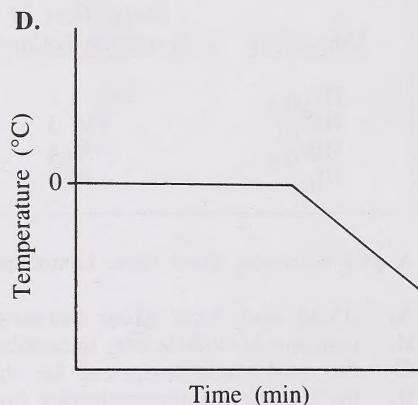
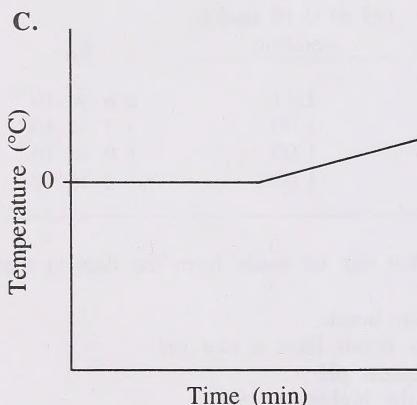
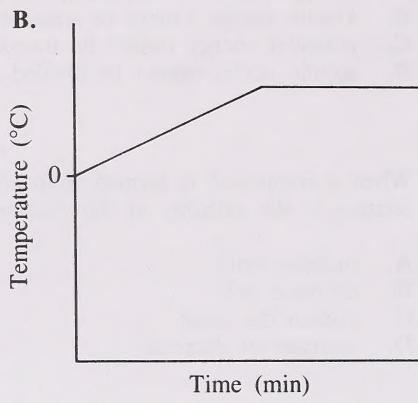
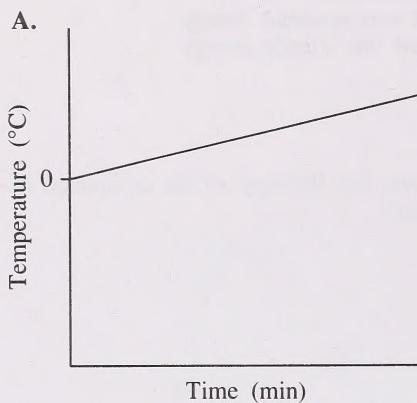
Use the following data to answer question 3.

Compound	Molar Heat of Formation (kJ/mol)	pH of 0.10 mol/L Solution	K_a
$\text{HF}_{(g)}$	-271.1	2.11	6.6×10^{-4}
$\text{HCl}_{(g)}$	-92.3	1.00	1.3×10^6
$\text{HBr}_{(g)}$	-36.4	1.00	1.0×10^9
$\text{HI}_{(g)}$	+26.5	1.00	3.2×10^9

- A generalization about these compounds that can be made from the data is that
 - strong acids have strong intramolecular bonds
 - compounds with strong intramolecular bonds have a low pH
 - the most stable compound has the highest pH
 - the weaker the intramolecular bond, the higher the pH

- An exothermic reaction occurs in a calorimeter. The water of the calorimeter
 - absorbs heat and a rise in temperature is observed
 - absorbs heat and a drop in temperature is observed
 - releases heat and a rise in temperature is observed
 - releases heat and a drop in temperature is observed

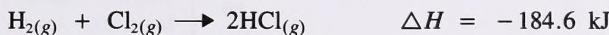
5. Which graph best represents the change in temperature that occurs when heat is added to a sample of ice initially at 0°C ?



6. The reaction that involves the largest change in energy per mole of substance is the
- A. sublimation of water
 - B. combustion of magnesium
 - C. formation of liquid water from the elements
 - D. fusion of hydrogen atoms to produce helium

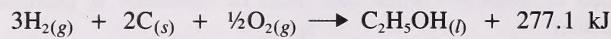
7. The molar heat of a phase change is the amount of energy
- A. released or absorbed when one mole of substance is changed from one phase to another
 - B. released or absorbed when one mole of substance is formed from its elements
 - C. needed to raise the temperature of one mole one degree Celsius
 - D. needed to raise the temperature of one gram one degree Celsius

Use the following information to answer question 8.



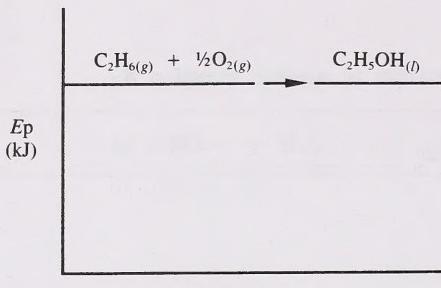
8. The ΔH represents the enthalpy
- A. change during the reaction
 - B. absorbed by the reaction
 - C. required to form H-Cl bonds
 - D. required to break H-H and Cl-Cl bonds
-
9. A substance has a molar heat of combustion of -810.4 kJ/mol . When 0.285 mol of the substance is burned in a calorimeter containing 8.60 kg of water, the increase in water temperature is
- A. 0.156°C
 - B. 6.41°C
 - C. 7.89°C
 - D. 12.8°C

Use the following information to answer question 10.

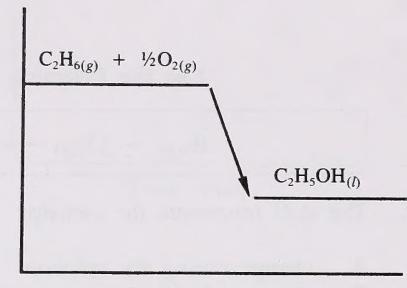


10. The diagram that represents the reaction $\text{C}_2\text{H}_6(g) + \frac{1}{2}\text{O}_{2(g)} \rightarrow \text{C}_2\text{H}_5\text{OH}_{(l)}$ is

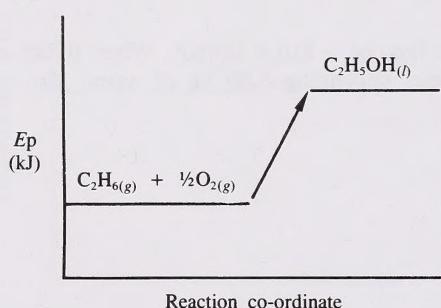
A.



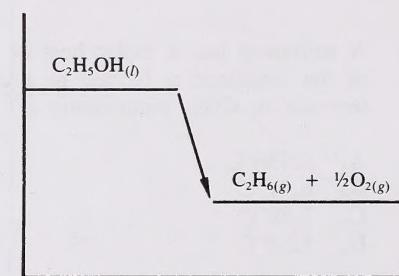
B.



C.



D.

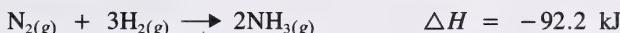


11. The molar heat of combustion for propane to its gaseous products is

- A. -2251.5 kJ/mol
- B. -2219.9 kJ/mol
- C. -2043.9 kJ/mol
- D. -531.5 kJ/mol

12. Given that the molar heat of fusion of sodium is 2.63 kJ/mol, how much energy is needed to completely melt 180 g of solid sodium at its melting point?
- A. 2.63 kJ
B. 2.98 kJ
C. 20.6 kJ
D. 473 kJ
13. When the three types of energy changes are arranged in order of decreasing molar heat values, the order is
- A. phase, chemical, nuclear
B. chemical, phase, nuclear
C. nuclear, phase, chemical
D. nuclear, chemical, phase

Use the following information to answer question 14.



14. The heat of reaction for the decomposition of one mole of ammonia is
- A. +92.2 kJ
B. +46.1 kJ
C. -46.1 kJ
D. -92.2 kJ
-
15. A 0.1 mol/L solution that conducts electricity and turns blue litmus red is
- A. $\text{SrCl}_{2(aq)}$
B. $\text{CH}_3\text{Cl}_{(aq)}$
C. $\text{NaCl}_{(aq)}$
D. $\text{HCl}_{(aq)}$
16. Which 50.0 mL solution requires the greatest volume of 0.100 mol/L $\text{HCl}_{(aq)}$ to completely react with it?
- A. 0.100 mol/L $\text{NaOH}_{(aq)}$
B. 0.100 mol/L $\text{NH}_3_{(aq)}$
C. 0.100 mol/L $\text{Ba(OH)}_2_{(aq)}$
D. 0.100 mol/L $\text{HOOCOOH}_{(aq)}$

17. The weakest electrolyte would be a 0.10 mol/L solution of
- $\text{HCl}_{(aq)}$
 - $\text{NaCl}_{(aq)}$
 - $\text{NaOH}_{(aq)}$
 - $\text{HOCl}_{(aq)}$
18. A species that behaves as either an acid or a base is
- $\text{CO}_{2(g)}$
 - $\text{CH}_3\text{OH}_{(l)}$
 - $\text{HCO}_3^-_{(aq)}$
 - $\text{PO}_4^{3-}_{(aq)}$
19. A 0.10 mol/L solution containing a single dissolved substance is a very good conductor of electricity and turns blue litmus paper red. The pH of this solution could be approximately
- 1.4
 - 5.6
 - 7.0
 - 12.3

Use the following data to answer question 20.

<u>$[\text{OH}^-_{(aq)}]$</u>	<u>pH</u>	<u>Description</u>	<u>Color in Bromothymol blue</u>
1×10^{-5} mol/L	—	—	—

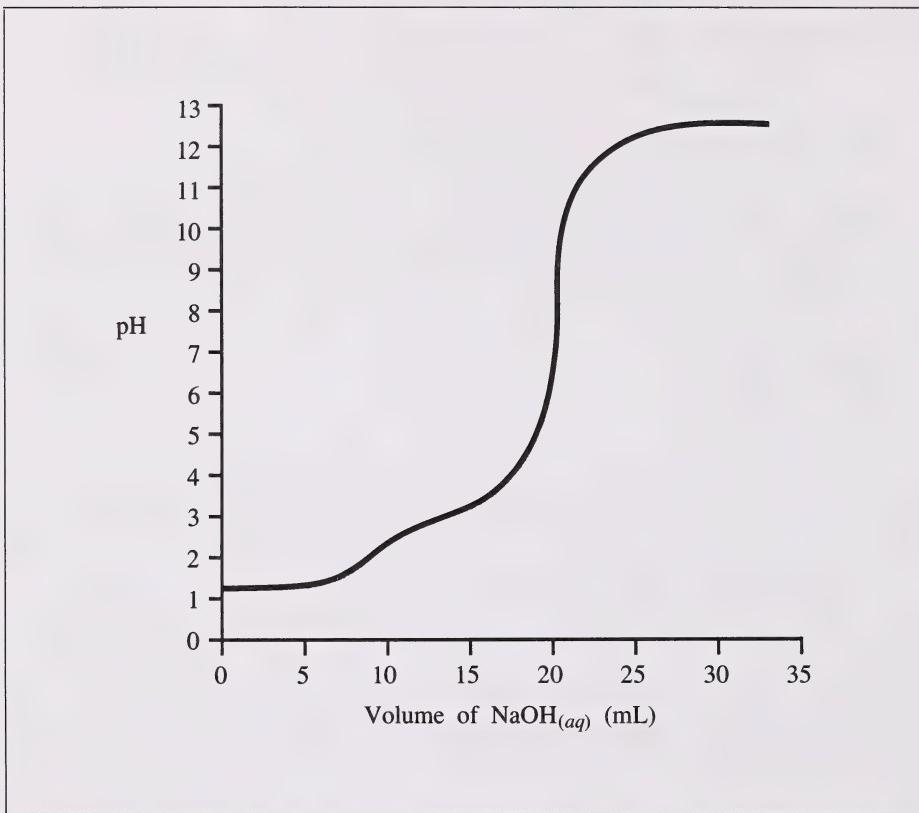
20. The missing data under the headings pH, description, and color in bromothymol blue respectively are
- 5, acidic, blue
 - 5, acidic, yellow
 - 9, basic, blue
 - 9, basic, green
-

21. The $[\text{H}_3\text{O}^+_{(aq)}]$ in 0.020 mol/L $\text{Ba(OH)}_2_{(aq)}$ is
- A. 2.5×10^{-13} mol/L
 - B. 5.0×10^{-12} mol/L
 - C. 4.0×10^{-2} mol/L
 - D. 1.6×10^{-1} mol/L
22. A solution with a pH of 5 is
- A. basic with $[\text{OH}^-_{(aq)}] = 10^{-5}$ mol/L
 - B. acidic with $[\text{H}_3\text{O}^+_{(aq)}] = 10^{-5}$ mol/L
 - C. acidic with $[\text{OH}^-_{(aq)}] = 10^{-5}$ mol/L
 - D. basic with $[\text{H}_3\text{O}^+_{(aq)}] = 10^{-5}$ mol/L
23. Excess zinc is added to 150 mL of 0.10 mol/L $\text{HCl}_{(aq)}$. When the reaction is complete, four drops of bromothymol blue solution are added. What is the color of the solution?
- A. Colorless
 - B. Yellow
 - C. Green
 - D. Blue
24. The net ionic equation for the neutralization of ammonia with hydrobromic acid is
- A. $\text{HBr}_{(aq)} + \text{NH}_3_{(aq)} \rightarrow \text{Br}^-_{(aq)} + \text{NH}_4^+_{(aq)}$
 - B. $\text{H}_3\text{O}^+_{(aq)} + \text{NH}_3_{(aq)} \rightarrow \text{H}_2\text{O}_{(l)} + \text{NH}_4^+_{(aq)}$
 - C. $\text{HBr}_{(aq)} + \text{NH}_4\text{OH}_{(aq)} \rightarrow \text{H}_2\text{O}_{(l)} + \text{NH}_4\text{Br}_{(aq)}$
 - D. $\text{H}_3\text{O}^+_{(aq)} + \text{NH}_4\text{OH}_{(aq)} \rightarrow \text{NH}_4^+_{(aq)} + 2\text{H}_2\text{O}_{(l)}$
25. When equal volumes of 0.10 mol/L solutions of $\text{H}_3\text{BO}_3_{(aq)}$ and $\text{KCH}_3\text{COO}_{(aq)}$ are mixed together, the following equilibrium is established:
- $$\text{H}_3\text{BO}_3_{(aq)} + \text{CH}_3\text{COO}^-_{(aq)} \rightleftharpoons \text{H}_2\text{BO}_3^-_{(aq)} + \text{CH}_3\text{COOH}_{(aq)}$$
- This equilibrium condition
- A. favors the left side
 - B. favors the right side
 - C. favors neither side because all concentrations are equal
 - D. is impossible to determine from the available information

26. The equivalence point in an acid-base titration will have a pH of 7 for the titration of

- A. $\text{OH}^{-}_{(aq)}$ with vinegar
- B. ammonia with $\text{H}_3\text{O}^{+}_{(aq)}$
- C. acetic acid with potassium hydroxide
- D. hydrochloric acid with sodium hydroxide

Use the following graph to answer question 27.



27. The acid in the titration is

- A. $\text{HOOCOOH}_{(aq)}$
- B. $\text{CH}_3\text{COOH}_{(aq)}$
- C. $\text{HNO}_3_{(aq)}$
- D. $\text{HCl}_{(aq)}$

28. In the reaction $\text{HCl}_{(g)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{H}_3\text{O}^+_{(aq)} + \text{Cl}^-_{(aq)}$, water is
- A. an acid
 - B. a proton donor
 - C. an electron acceptor
 - D. a proton acceptor
29. When a substance undergoes oxidation, it always
- A. loses electrons
 - B. decreases its oxidation number
 - C. becomes positively charged
 - D. attains zero charge
30. Which species is reduced in the reaction
 $\text{Cr}_2\text{O}_7^{2-}_{(aq)} + 14\text{H}^+_{(aq)} + 3\text{Sn}^{2+}_{(aq)} \rightarrow 3\text{Sn}^{4+}_{(aq)} + 2\text{Cr}^{3+}_{(aq)} + 7\text{H}_2\text{O}_{(l)}$?
- A. $\text{Cr}_2\text{O}_7^{2-}_{(aq)}$
 - B. $\text{Cr}^{3+}_{(aq)}$
 - C. $\text{Sn}^{2+}_{(aq)}$
 - D. $\text{Sn}^{4+}_{(aq)}$
31. For the reaction $2\text{Sn}^{2+}_{(aq)} \rightarrow \text{Sn}_{(s)} + \text{Sn}^{4+}_{(aq)}$, a correct statement is that the
- A. reaction is spontaneous
 - B. reaction involves a decrease in potential energy
 - C. $\text{Sn}^{2+}_{(aq)}$ is both the oxidizing and the reducing agent
 - D. $\text{Sn}_{(s)}$ is the oxidizing agent in this nonspontaneous reaction
32. A solution of acidified potassium permanganate is stored in an iron container. The net ionic equation for a reaction that occurs is
- A. $\text{MnO}_4^-_{(aq)} + 8\text{H}^+_{(aq)} + 5\text{K}_{(s)} \rightarrow \text{Mn}^{2+}_{(aq)} + 4\text{H}_2\text{O}_{(l)} + 5\text{K}^+_{(aq)}$
 - B. $2\text{MnO}_4^-_{(aq)} + 16\text{H}^+_{(aq)} + 5\text{Fe}_{(s)} \rightarrow 2\text{Mn}^{2+}_{(aq)} + 5\text{Fe}^{2+}_{(aq)} + 8\text{H}_2\text{O}_{(l)}$
 - C. $\text{MnO}_4^-_{(aq)} + 8\text{H}^+_{(aq)} + \text{Fe}^{2+}_{(aq)} \rightarrow \text{Mn}^{2+}_{(aq)} + \text{Fe}^{3+}_{(aq)} + 4\text{H}_2\text{O}_{(l)}$
 - D. $\text{MnO}_4^-_{(aq)} + 8\text{H}^+_{(aq)} + \text{Fe}_{(s)} \rightarrow \text{Mn}^{2+}_{(aq)} + 4\text{H}_2\text{O}_{(l)} + \text{Fe}^{2+}_{(aq)}$

33. In the compound $\text{Sb}_4\text{O}_{6(s)}$, antimony has an oxidation state of
- 0
 - +3
 - +4
 - +6
34. In the methane-oxygen fuel cell reaction
 $\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(g)}$ $E^\circ_{\text{net}} = 1.05 \text{ V}$,
 oxidation numbers show that
- oxygen atoms lose electrons
 - hydrogen atoms gain electrons
 - O_2 is the reducing agent
 - carbon atoms lose electrons
35. If the scale for electrode potentials is changed so that the reduction of
 $\text{Ni}^{2+}_{(aq)} + 2\text{e}^- \rightleftharpoons \text{Ni}_{(s)}$ is 0.00 V, the electrode potential for the reduction of
 $\text{Br}_2(l)$ will be
- +0.26 V
 - +0.81 V
 - +1.07 V
 - +1.33 V

Use the following information to answer question 36.

Oxidation Potential Table

$\text{C}_{(s)} \rightarrow \text{C}^{3+}_{(aq)} + 3\text{e}^-$	$E^\circ = +1.80 \text{ V}$
$\text{D}_{(l)} \rightarrow \text{D}^{2+}_{(aq)} + 2\text{e}^-$	$E^\circ = +0.35 \text{ V}$
$\text{A}^{2+}_{(aq)} \rightarrow \text{A}^{4+}_{(aq)} + 2\text{e}^-$	$E^\circ = -0.25 \text{ V}$
$2\text{B}^-_{(aq)} \rightarrow \text{B}_{2(g)} + 2\text{e}^-$	$E^\circ = -1.25 \text{ V}$

36. The strongest oxidizing agent in this table is
- $\text{C}_{(s)}$
 - $\text{B}_{2(g)}$
 - $\text{A}^{4+}_{(aq)}$
 - $\text{D}^{2+}_{(aq)}$
-

Use the following information to answer question 37.

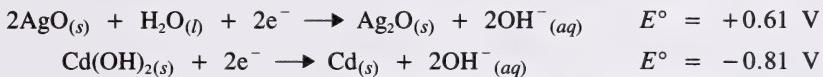
<u>Statement</u>	<u>Explanation</u>
$\text{F}_{2(g)}$ is a strong reducing agent.	$\text{F}_{2(g)}$ has a strong attraction for electrons.

- 37.** Based on this information, one should determine that

- A. both the statement and the explanation are true, and that the explanation is correct for the statement
 - B. both the statement and the explanation are true, but the explanation is not correct for the statement
 - C. the statement is true, but the explanation is false
 - D. the statement is false, but the explanation is true
-

Use the following information to answer question 38.

An AgO-Cd cell is used in satellite batteries. This cell is very compact and it can supply much energy.



- 38.** The E°_{net} value for this cell is

- A. -1.42 V
 - B. -0.20 V
 - C. $+0.20 \text{ V}$
 - D. $+1.42 \text{ V}$
-

- 39.** Which reactants will result in a spontaneous reaction?

- A. $\text{Fe}^{2+}_{(aq)} + \text{Pb}^{2+}_{(aq)}$
- B. $\text{Cr}^{2+}_{(aq)} + \text{Zn}^{2+}_{(aq)}$
- C. $\text{Sn}^{2+}_{(aq)} + \text{I}_{2(s)}$
- D. $\text{Na}^+_{(aq)} + \text{Pb}_{(s)}$

40. In a functioning electrochemical cell,
- A. anions migrate inside the cell from the anode to the cathode
 - B. cations migrate inside the cell from the cathode to the anode
 - C. electrons move in the external circuit from the anode to the cathode, where reduction occurs
 - D. electrons move in the external circuit from the cathode to the anode, where reduction occurs
41. An electrolytic cell contains 2.00 mol/L $\text{NiCl}_2(aq)$ and operates at 0.500 A. To plate out 5.87 g of $\text{Ni}_{(s)}$, how long would this cell have to function?
- A. 1.93×10^4 s
 - B. 3.86×10^4 s
 - C. 7.72×10^4 s
 - D. 1.54×10^5 s
42. Which cell is capable of recharging a 1.25 V battery?
- A. $\text{Ag}_{(s)}/\text{Ag}^{+}(aq)//\text{Cu}^{2+}(aq)/\text{Cu}_{(s)}$
 - B. $\text{Al}_{(s)}/\text{Al}^{3+}(aq)//\text{Sn}^{2+}(aq)/\text{Sn}_{(s)}$
 - C. $\text{Co}_{(s)}/\text{Co}^{2+}(aq)//\text{Pb}^{2+}(aq)/\text{Pb}_{(s)}$
 - D. $\text{Fe}_{(s)}/\text{Fe}^{2+}(aq)//\text{Ni}^{2+}(aq)/\text{Ni}_{(s)}$

YOU HAVE NOW COMPLETED PART A. PROCEED DIRECTLY TO PART B.

PART B

INSTRUCTIONS

In this part of the examination, there are seven numerical-response questions each with a value of one mark. All numbers used in the questions are to be considered as the result of a measurement.

Read each question carefully.

Record your answer on the answer sheet provided by writing it in the boxes and filling in the corresponding circles.

Enter the first digit of your answer in the left-hand box and leave any unused boxes blank.

Use an HB pencil only.

Sample Calculation Question and Solution

The mass in grams of silver produced when 0.220 mol of silver nitrate reacts with excess copper is _____ g.
(Record your answer to three digits.)

$$\begin{aligned}\text{mass}_{\text{Ag}} &= 0.220 \text{ mol} \times 107.87 \text{ g/mol} \\ &= 23.7314 \text{ g} \\ &= 23.7 \text{ g (rounded to three digits)}\end{aligned}$$

Record 23.7

Answer Sheet

1		
2	3	.
4	5	6
7	8	9
0	1	2
3	4	5
6	7	8
9	0	1
2	3	4
5	6	7
8	9	0
1	2	3
4	5	6
7	8	9
0	1	2
3	4	5
6	7	8
9	0	1

Sample Correct-order Question and Solution

When the following subjects are arranged in alphabetical order, the order is _____ .
(Record all four digits.)

1. mathematics
2. chemistry
3. biology
4. physics

Answer 3, 2, 1, 4

Record 3214

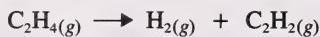
Answer Sheet

2		
3	2	1
4	5	6
7	8	9
0	1	2
3	4	5
6	7	8
9	0	1
2	3	4
5	6	7
8	9	0
1	2	3
4	5	6
7	8	9
0	1	2
3	4	5
6	7	8
9	0	1

If you wish to change an answer, erase all traces of your first answer.

START PART B IMMEDIATELY.

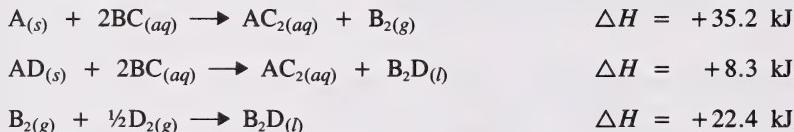
Use the following reaction to answer question 1.



1. The ΔH for this reaction is _____ $\times 10^2$ kJ. (Record your answer to three digits.)

RECORD THE ANSWER ON THE ANSWER SHEET

Use the following information to answer question 2.



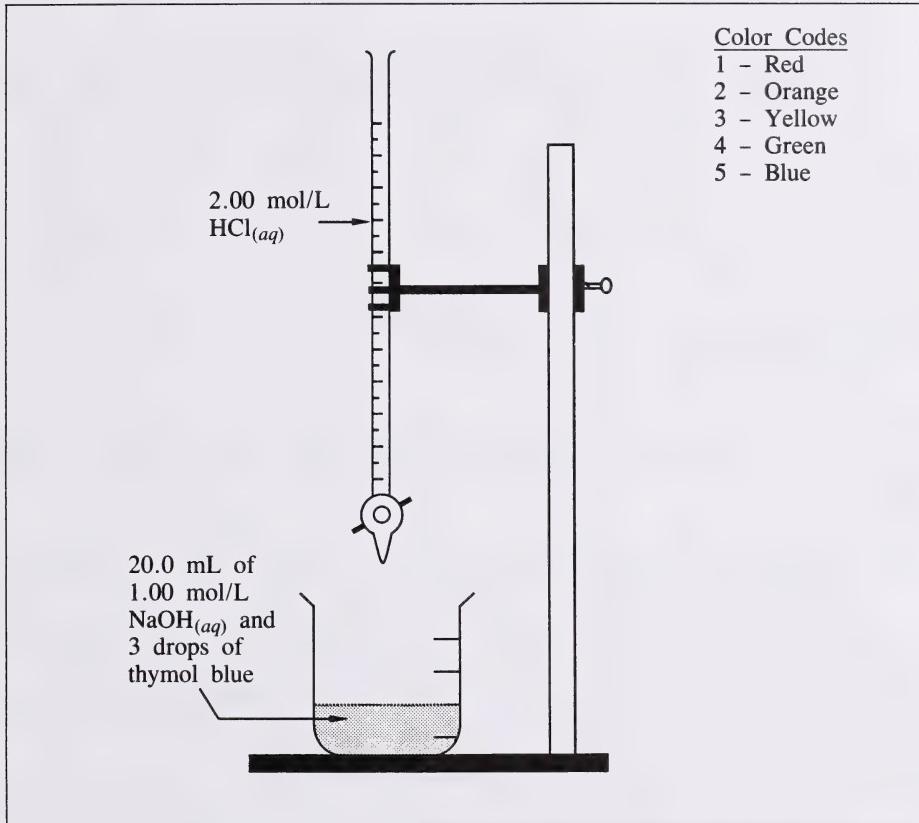
2. The ΔH for the reaction $\text{A}_{(s)} + \frac{1}{2}\text{D}_{2(g)} \longrightarrow \text{AD}_{(s)}$ is _____ kJ. (Record your answer to three digits.)

RECORD THE ANSWER ON THE ANSWER SHEET

3. When heat is applied to a 15.0 g sample of copper metal, the temperature of the copper increases from 23.0°C to 380.0°C. An equal amount of heat is applied to an unknown mass of aluminum and causes the same temperature change. The mass of aluminum is _____ g. (Record your answer to three digits.)

RECORD THE ANSWER ON THE ANSWER SHEET

Use the following diagram and color code to answer question 4.



4. The code for the color of the solution in the beaker when

- no $\text{HCl}_{(aq)}$ is added is _____ (Record in first column)
- 5.0 mL of $\text{HCl}_{(aq)}$ are added is _____ (Record in second column)
- 10.0 mL of $\text{HCl}_{(aq)}$ are added is _____ (Record in third column)
- 15.0 mL of $\text{HCl}_{(aq)}$ are added is _____ (Record in fourth column)

RECORD THE ANSWER ON THE ANSWER SHEET

Use the following information to answer question 5.

Solution	Indicator Color		
	phenolphthalein	indigo carmine	methyl orange
1	colorless	blue	red
2	pink	yellow	yellow
3	colorless	blue	yellow
4	pink	blue	yellow

5. When these solutions are arranged from highest to lowest pH value, their numerical sequence is _____. (Record all four digits.)

RECORD THE ANSWER ON THE ANSWER SHEET

6. In an operating electrochemical cell using an $\text{Al}_{(s)}$ anode and a $\text{Ag}_{(s)}$ cathode, the mass of the anode decreases by 0.270 g. The increase in the mass of the cathode is _____ g. (Record your answer to three digits.)

RECORD THE ANSWER ON THE ANSWER SHEET

Use the following information to answer question 7.

Cell I	$E^\circ_{\text{net}} = 1.33 \text{ V}$	anode: $\text{Ni}_{(s)} \rightarrow \text{Ni}^{2+}_{(aq)} + 2\text{e}^-$ cathode: $\text{X}_{2(s)} + 2\text{e}^- \rightarrow 2\text{X}^-_{(aq)}$
Cell II	$E^\circ_{\text{net}} = 0.23 \text{ V}$	anode: $\text{A}_{(s)} \rightarrow \text{A}^{2+}_{(aq)} + 2\text{e}^-$ cathode: $\text{Ni}^{2+}_{(aq)} + 2\text{e}^- \rightarrow \text{Ni}_{(s)}$

7. The predicted cell potential for the spontaneous reaction that occurs by combining the half-cells $2\text{X}^-_{(aq)}/\text{X}_{2(s)}$ and $\text{A}^{2+}_{(aq)}/\text{A}_{(s)}$ is _____ V. (Record your answer to three digits.)

RECORD THE ANSWER ON THE ANSWER SHEET

YOU HAVE NOW COMPLETED PART B. PROCEED DIRECTLY TO PART C.

PART C

INSTRUCTIONS

In this part of the examination, there are three written-response questions for a total of 21 marks. All numbers used in the questions are to be considered as the result of a measurement.

Read each question carefully.

Write your answers in the examination booklet as neatly as possible.

For full marks, your answers **must show** all pertinent explanations, calculations, and formulas. Your answers **should be** presented in a well-organized and appropriate manner; for example, complete sentences for a written response, and correct units and significant digits for a numerical response.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

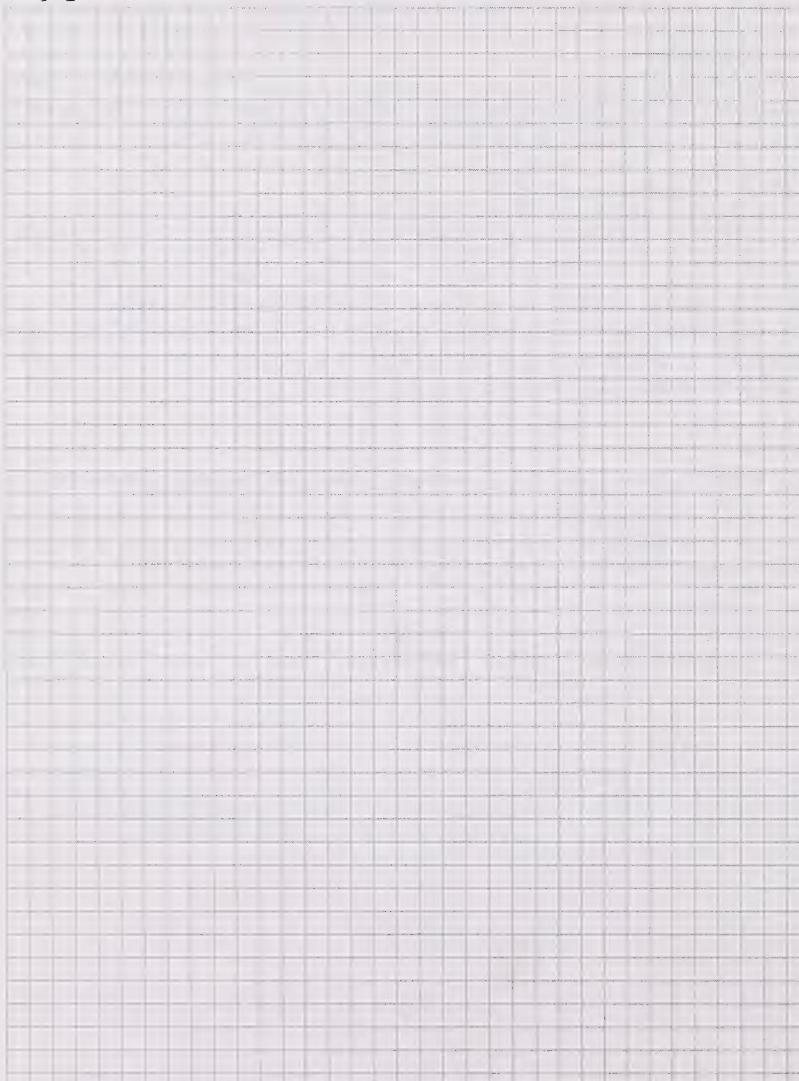
START PART C IMMEDIATELY.

(8 marks)

1. A student recorded data during the titration of a 25.0 mL sample of an unidentified base with 0.100 mol/L $\text{HCl}_{(aq)}$:

Volume of Acid (mL)	pH	Volume of Acid (mL)	pH
0.00	10.1	40.00	5.0
10.00	9.1	45.00	2.2
20.00	8.9	50.00	1.9
30.00	8.3	60.00	1.6
35.00	7.9	70.00	1.5

Use the following grid together with the data in this table to answer the questions on page 19.



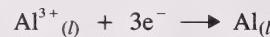
- a. On the grid provided on page 18, carefully plot the data from the table. Mark the equivalence point on the graph with a neat “x” and label it. Then calculate the initial concentration of the unidentified base.

b. What indicator would be suitable for use in this titration?

c. What conclusion can you draw about the strength of the base? Justify your answer.

Use the following information to answer question 2.

- Aluminum is produced by the electrolysis of molten ore. The reaction at the cathode of the electrolytic cell can be simplified and written as



- The energy required to produce aluminum by electrolysis is 72 kJ/g.
- Electrolysis is not required when aluminum is recycled. A major energy expenditure in recycling is the energy required to heat the aluminum to its melting point and to melt it.
- The molar heat of fusion of $\text{Al}_{(s)}$ is 10.7 kJ/mol.

(6 marks)

2. a. Calculate the amount of energy required to recycle a 16.1 g aluminum pop can. Assume that the aluminum for recycling is at an initial temperature of 20°C.
- b. Give an advantage and a disadvantage of recycling aluminum compared with producing it from ore by electrolysis. Should aluminum be recycled? Justify your answer.

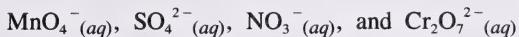
Use the following information to answer question 3.

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A student was given four solutions labelled A, B, C, and D. One contained $\text{Cl}^-_{(aq)}$ ions, one contained $\text{Br}^-_{(aq)}$ ions, one contained $\text{Sn}^{2+}_{(aq)}$ ions, and one contained $\text{Fe}^{2+}_{(aq)}$ ions.

In order to identify each solution, the student selected the following acidified reagents:



The student combined some of each solution with the reagents and recorded these results:

<u>Reagents</u>	<u>Unknown Solutions</u>			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
$\text{MnO}_4^-_{(aq)}, \text{H}^+_{(aq)}$	✓	✓	✓	✓
$\text{SO}_4^{2-}_{(aq)}, \text{H}^+_{(aq)}$	✗	✗	✓	✗
$\text{NO}_3^-_{(aq)}, \text{H}^+_{(aq)}$	✗	✓	✓	✗
$\text{Cr}_2\text{O}_7^{2-}_{(aq)}, \text{H}^+_{(aq)}$	✓	✓	✓	✗

3. If “✓” indicates a spontaneous reaction and “✗” indicates no reaction, identify what each solution contained. Explain how you reached your conclusions.

(7 marks)

YOU HAVE NOW COMPLETED THE EXAMINATION.

(NO MARKS WILL BE GIVEN FOR WORK DONE ON THIS PAGE)

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(NO MARKS WILL BE GIVEN FOR WORK DONE ON THIS PAGE)

FOLD AND TEAR ALONG PERFORATION

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CHEMISTRY 30

June 1992

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M2	<input type="checkbox"/>
M3	<input type="checkbox"/>
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